**Rainwater Management Strategies(RMS), Frameworks and Scenarios in the Nile BDC: including definitions and project interdependencies**

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8. RMS – *WHAT ARE WE TALKING ABOUT?*

The goal of the Nile BDC is to **improve rural livelihoods and their resilience through a landscape approach to rainwater management.**

This goal is based on a large body of research evidence which has established that significant potential exists for sustainable intensification to increase water productivity (WP) and reverse land degradation in agricultural systems that are producing far below potential (Bossio et al., 2007; Molden et al., 2007). These increases in productivity can have significant benefits to people in the Ethiopian context, as demonstrated in IWMI studies that found a range of small-scale water management interventions improve agricultural productivity, food security and livelihoods in the Ethiopian highlands (Hagos, et al. 2009). CPWF Phase I also concluded that improved water management can be an important part of increasing land and labour productivity, producing more food at a lower cost, generating employment and fostering equitable economic growth (Harrington et al. 2009).

In rainfed farming systems, dramatically increased WP and crop production can be achieved with small amounts of water, if timed to mitigate yield losses from dry spells, and if other needed inputs are available (Rockstrom et al. 2007). Livestock management such as feeding strategies has a role in increasing WP and productivity (Peden et al., 2007, 2009). CPWF Phase I concludes that integration of livestock typically results in higher water productivity when compared to similar systems without livestock, (Harrington et al. 2009).

Increasing production is not always sustainable. A growing demand for crop and livestock products continues to drive extensification - extension of agriculture into low potential areas throughout the Ethiopian Highlands, and in very few cases is driving intensification. Both extensificaiton and intensification are increasing pressure on water and other natural resources and threatening to undermine long-term productivity (Descheemaeker et al., 2009). Approaches to improving livelihoods and resilience need to take into account complex linkages between different components of agricultural and livelihood systems. Connectivity to markets or finance and the institutional coherence with which water and land resources are shared have an impact on performance  (Cook et al. 2009).

Past development interventions are more disappointing than research suggests they should be. Past research also has taken a limited view by focusing excessively on the cropped fields during the main rainy season only. A landscape approach where the water (and related) needs of crops, livestock, trees and other ecosystem services both during the rainy and non-rainy season to enhance the productivity and improve livelihoods has remained elusive.. As such the impact on rural livelihoods has been limited for a variety of reasons, including: i) blanket approaches favored by policy makers have mixed success ii) interventions are typically technology-oriented and not supported by effective policies and institutions iii) research findings are sectoral and insufficiently linked with overall development; iv) lack of understanding of the inter-linkages (biophysical and social) that occur between different landscape components (World Bank, 2006; Kristjanson et. al. 2009).

Thus our work aims to provide rainwater management strategies that draw on:

* Detailed understanding of how landscapes function (biophysically and socially), how different landscape components are connected and how changes in one component will bring about direct and indirect changes in others.
* Understanding of the causes and consequences of low rainwater productivity.
* An integration of the biophysical, technical, political, institutional and socio-economic aspects.
* Targeted, context specific interventions that reflect local challenges, values, agro-ecologies, production systems and communication channels feeding into the bigger basin wide development challenges.
* Local community (particularly women and the poor) and institutional participation in all project phases
* Using entry points enabling individuals and local institutions to influence change.

To operationalize the concept of Rainwater Management the Nile BDC, a definition of Rainwater Management Strategies (RMS) is necessary. For this the guiding principle was that RMS must be framed in a way that is useful for communication and analysis at a variety of scales, including recommendation domains, impact assessment and scenarios. These then provide the basis for complementary impact assessment at different scales and potential for nested scenarios.

Rainwater Management Strategies (RMS) will have four elements:

A **goal,** and a **strategy** to reach the goal that includes **interventions** needed to achieve change in **practice** at farm, landscape, or even higher levels. Bottom up and top down interactive approaches used to define them.

1. Goal: A general goal related to the vision of the Nile BDC, or specific study landscapes

* The goal can be considered our translation of the project goals/impact into measureable objectives
* Goals are defined with attention to possibilities for measurable change (through scenarios) in e.g. water use, ecosystem services, tree cover, markets or livelihoods that is scalable

1. Strategy: plan to achieve the goal including a combination of interventions and practices at different locations within the landscape aiming at the goal.

* Strategies should be specific to each study landscape with attention to differences in state of development, ecosystem factors, actors, and promising entry points/opportunities.
* Strategies will have generic elements that are applicable elsewhere in the basin and for planning purposes
* Strategies take account the social and physical landscape and various niches existing, considering the local resources base (soils, water, human capacity…) and available knowledge, expertise and innovations.

1. Practice: a way of doing something; this suggests that an actor (farmer or community) decides to do something

* A practice can address single (or similar) niche(s) in the landscape
* A combination of practices can be proposed to address multiple (or variable) niches

1. Intervention: anything done to achieve a practice change that is useful towards achieving the goal

* In Nile BDC interventions may be aimed at actors at various levels leading to changed practices at farm level

*1.1.Proposed RMS for the Nile BDC*

**Nile BDC**

Goal

Increase access to and productive use of water in the landscape with improved livelihoods and ecosystem services.

**Fogera**

Goal

Increase tree cover and fodder availability, increase water storage and water productivity, increase area under dry season irrigation, reduce siltation, and improve access to input-output markets: Upland catchment management with emphasis to retire highly degraded lands to trees of economic/ nutrition value, enhanced water storage for critical in-season/ off-season irrigation in the midlands and ensure efficient use of limited off-season water resources for high-value agriculture in the low lands.

**Strategy**

Practices

* Rain water harvesting structures in upstream and midlands
* Intensified (?) small scale irrigation in paddy fields, including addressing waterlogging and flooding
* Groundwater pumping and efficient use for vegetables and *chat* cultivation, and to increase cropping intensity
* Rooftop rainwater harvesting to meet domestic, livestock and homestead irrigation needs.
* Integrated soil fertility management, in both upstream and down stream
* Soil conservation measures with fodder as stabilizers
* Gully rehabilitation in midlands
* Reforestation and fruit trees in upstream
* Livestock fodder improvement
* Animal health including Tse Tse control

Interventions

Make good use of the highly organized *Awramba* community and progressive farmers for validation, impact and outscaling. (<http://www.youtube.com/watch?v=vJzuiAIMFio&NR=1>)

* Linking the local players (e.g. the woreda bureau of agriculture, Participatory Small-scale Irrigation Development, Bahir-Dar University ) with regional, national and international research institutes for improved water storage, access (pumps) and utilization
* Organization for collective action though innovation platforms
* Increase capacity of planners to use improved integration tools (by sector and landscape niche) through training and co-learning

Develop technical capacity in tree management and facilitate supply of planting material

* Foster collective action to develop grazing bylaws
* Organize cooperative pumping and water markets for efficient and equitable use of limited resource during non-rainy season.
* Strengthen value chains and marketing strategies (including collective action)

**Diga**

Goal

Maintain/increase forest cover and other environmental services, increase fruit trees and productivity of coffee, and ability to access new markets: Improved orchard (especially mango) and plantation establishment, management and rejuvenation of old orchards in the uplands, intensification of agriculture in the mid- and lowlands and promote improved cultivation of coffee and other high value agriculture in the low lands. Improve performance of small-scale diversion schemes

**Strategy**

Practices

* Diversify and increase fruit trees (especially mango) and coffee and spices as major enterprises of the landscape
* Small scale irrigation through diversion schemes
* Limited groundwater development
* In-situ and off-situ rainwater harvesting
* Meeting livestock water needs- better waterhole management
* Integrated Soil fertility management in both upstream and down stream
* Soil conservation measures with fodder/ trees as stabilizers
* Poultry and Livestock fodder improvement and health services,

Interventions

Engage with and learn from the experiences of *Maddejalala* settlement community for innovative sharing, development and management of water and land resources and agriculture diversification.

* Capacitate local actors (e.g. Wollega university, Bureau of Agriculture/ horticulture) to help farmers in improving fruit tree production and management
* Increase capacity of communities for collective action though innovation platforms
* Increase capacity of planners to use improved integration tools (by sector and landscape niche) through training and co-learning

Develop technical capacity in tree management and facilitate supply of planting material

* Foster collective action to develop market infrastructure
* Support development of value chains and marketing strategies for site specific products (e.g. honey)

**Jeldu**

Goal

Increase and diversify tree cover, system intensification including increased storage of water, transition to new crop varieties. Improve commercial cultivation of eucalyptus (replace with some alternative species of similar economic value for diversity) and control severity of land degradation in the uplands. Intensification of agriculture and livestock in the mid and lowlands and efficient diversion and use of stream water for diversified high value agriculture in the valley-bottoms.

**Strategy**

Practices

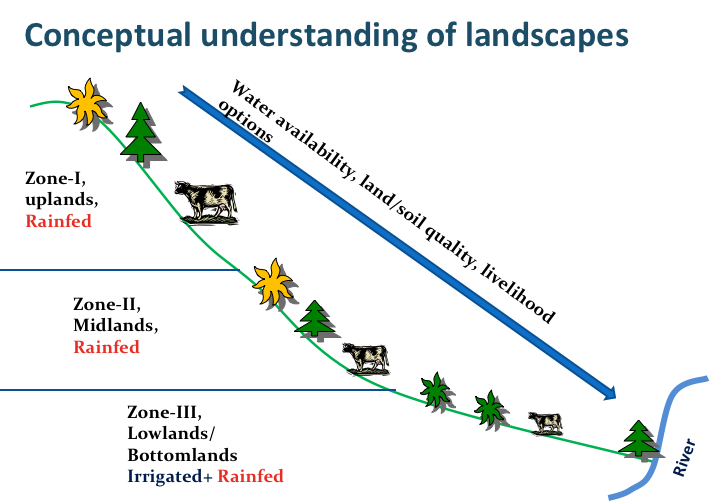
* Innovative methods of land and water conservation in the up and midlands to control erosion/ severe degradation
* Rainwater harvesting in small dug-out ponds for livestock watering and critical irrigation
* Out-scale the good work of Holletta Agricultural Research Centre for improved potato seed production and cultivation
* Improve the performance of diversion irrigation- especially the conveyance and application and efficient use and sharing in the small-scale water diversion schemes

Interventions

* Learn from the experiences and constraints of Melka village community for benefit sharing, impact and outscaling.
* Increase local capacity (e.g. EIAR and local NGOs) and communities for collective action though innovation platforms
* Increase capacity of planners to use improved integration tools (by sector and landscape niche) through training and co-learning

Develop technical capacity in tree management and facilitate supply of planting material

* Foster collective action to manage watersheds, particularly labor intensive soil and water conservation practices
* Support development of value chains and marketing strategies for site specific products –potatoes, eucalyptus wood (including collective action)

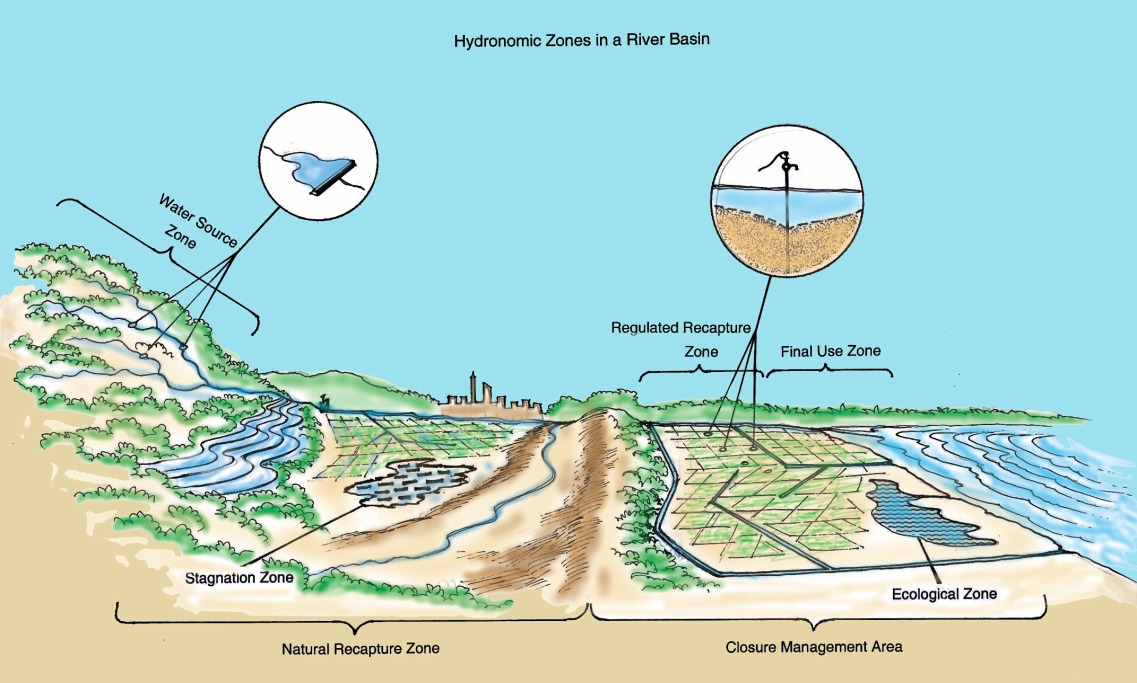


2. Landscape Rainwater Management

Rainwater management in the landscape means considering all the water in the landscape, including blue and green water, rainfall and rivers, soil water and ground water as the scope for water management. It also means addressing various landscape niches, and the interactions amongst them. A simple characterization of landscape niches includes uplands, midlands and lowlands, which require different types of land use practices (Fig). Another characterization from the water perspective has come from Molden et. al., (2000) in which hydronomic zones were delineated in a basin, water source, natural recapture, regulated recapture, and closure management zone in upper, middle and lowlands parts of the basin (Fig Molden et al.). The utility of these concepts is that they point out the need for different management aimed at the different physical characteristics of the zone. More importantly they highlight the different functions and purposes to which people use the zones, and towards which management is aimed. The ecosystem services concepts take these ideas further by characterizing a wide range of potential services of various landscape niches.

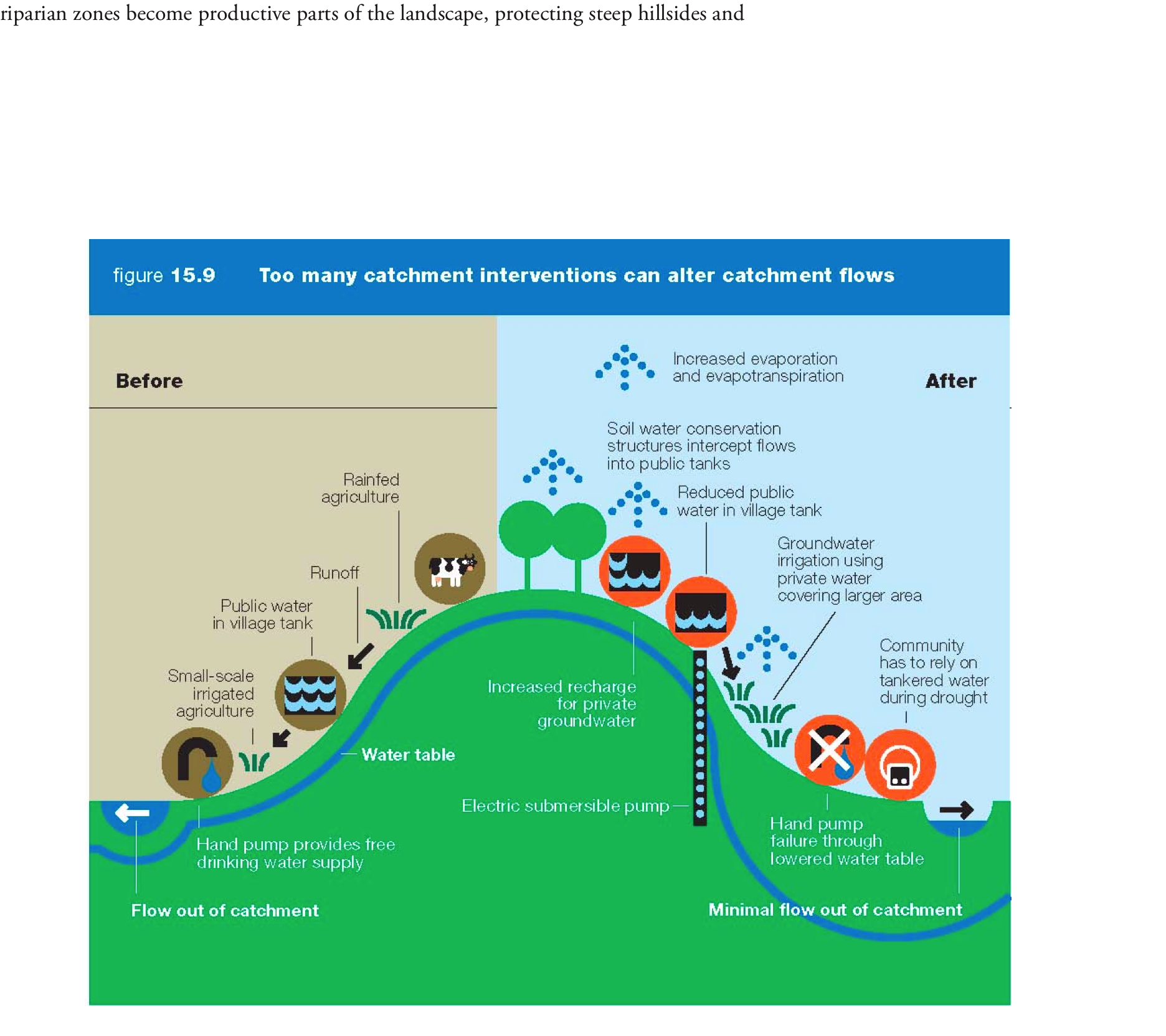
The interaction amongst niches are also critical. They are both biophysical – water causing erosion in the upper slopes is full of sediment and negatively impacts irrigation schemes in the lowlands, water used by trees in the uplands is not available in the lowlands for dry season irrigation – and social **(**fig Bossio et al.).

Molden et al., 2000

People exploit various biophysical niches for a variety of purposes and often try to maximize access to a range of niches. Feedbacks will be created when a practice change affects one area of the landscape, causing increased pressure and/or decreased pressure in another area. Thus the various interactions between physical niches and livelihood niches is another aspect to managing at landscape scales.

Landscape rainwater management thus has to consider not only niche specific practice changes and interventions, but also the various interactions amongst niches and potential feedbacks from biophysical and livelihood perspectives.

Figure : landscape niches in a landscape (Bossio et al., 2007)

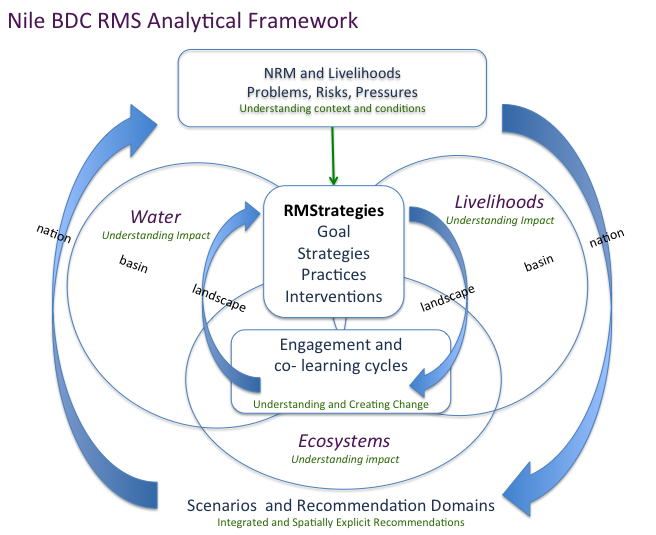


3. ANALYTICAL FRAMEWORK

An analytical framework for the project puts the RMS into perspective of the analysis/research/action of the project. The framework represents RMS at the center of the processes of the Nile BDC as well as the output recommendations in various forms.

The elements of the framework are analytical approaches and processes:

* The RMS for study landscapes and the basin
* The processes of engagement and co-learning with partners that includes innovation platforms at landscape and national levels, stakeholder consultations, trainings, and co-development of research outputs
* The impact assessments that include water, livelihoods, ecosystems and integration of these at various scales
* The scenarios and recommendation domains



Outputs of the project:

Tools, maps, analysis, knowledge, impact assessment, and scenarios

Outcomes of the project:

Farmers are testing and adopting of RMS practices at local level

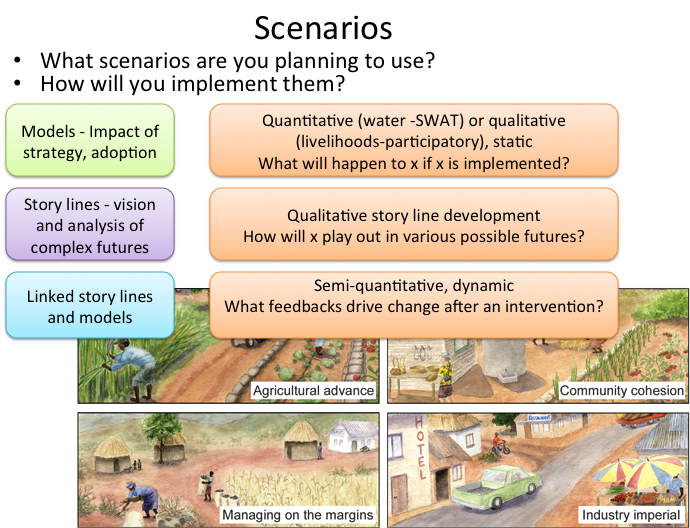
Local, regional and national planners are using new tools for planning

Researchers are

Policy makers are employing evidence-based decision-making at all levels

4. SCENARIOS

There are a wide variety of scenarios being proposed for various purposes across the Nile BDC. As a starting point to identify what we could do in the form of integrated nested scenarios for the Nile BDC we could start with a listing of the various scenarios already being considered, and a discussion of how RMS can be used in scenarios.



5. SCALES – *DO WE HAVE COMMON UNDERSTANDING AND ARE WE ADDRESSING THE RIGHT ONES WITH OUR METHODS?*

Scale can be defined as the extent of a problem studied (e.g. plot, farm, ecosystem, landscape). A related concept is the one of resolution, which is referring to the level of detail that is captured within the extent.

Primary scale of interest to N2 is the landscape as defined in the proposal:

“A combined physical and social unit large enough to encompass the range of land uses on which local communities depend, either directly for provisioning ecosystem services (food, fiber, livestock, wood) or regulating services (watershed functions), and a range of social institutions which are directly responsible for resource management.”

Analyzing RMS at landscape level requires:

* A systems approach
* Concurrently taking into account of environmental, social and cultural components
* Considering human welfare losses due to environmental degradation and the true costs and benefits of environmental protection.
* Taking account of multiple stakeholders with sometimes different land use objectives
* The recognition of overlapping cultural, social and governance landscapes within biophysically defined areas
* Policies affecting adoption of RWM practices

For this project we have chosen the Woreda to represent this landscape scale. Defined by a political boundary, it represents a meso-scale (biophysically between small watersheds and Basin, and socially/decision making between community and state). It must be noted however, that there are cross-boundary actors of various types that should also be considered.

This meso/landscape scale is a key innovative feature of the research projects.

In addition to capacity building, engaging in policy and research networks etc:

**N2** is responsible to:

*(note this is in the very simplest terms)*

1.Define RMStrategies for intervention that are relevant to the landscape (Woreda) -and provide guidance on identifying RMS

Measure the impacts of these strategies on:

a. Livelihoods (&equity)

b. WP (SYSTEM WP crops, livestock, trees) AT LANDSCAPE SCALE

c. Environment

(This to be done based on existing interventions more than implementing new infrastructure or other interventions, and scenarios, micro watershed used for primary hydrology data to support b, and hydrologic modeling improvement at larger scales too)

2. Analyze policy and institutional environment that contribute to or constrain success of RMStrategies

a. formal and informal institutions

b. planning, implementation and adoption actors AT LANDSCAPE

c. process of change and policy options (and maybe larger)

3. Strategies for Ethiopia Blue Nile and Scenarios AT LANDSCAPE SCALE

**N3** is responsible targeting and extrapolation (investment advice):

*(note this is in the very most simple terms)*

To be achieved through:

1. Similarity analysis of various units, mostly Woreda

2. Matching Strategies (through practices) (from N2 &

others) to map-able indices(suitability maps) BLUE NILE

3. Mapping possible scaling out potentials

4. Mapping recommendation domains

**N4** is responsible to:

*(note this is in the very most simple terms)*

1. Predict impact of widescale adoption of strategies

at different scales on:

a. Flows of water,sediment (and hence nutrients)

b. Productivity and WP BLUE NILE

c. Optimization, linking hydrology, land use practice and

economic aspects (and other)

d. Institutional consequences

e. economic implictions of RMS

2. Provide best lands use practices (productivity, WP, livelihood, economics) - at various scales, most likely in a nested approach; relating upstream downstream communities in an approach similar to PES; developing different scenarios of adoption and other water resource development with feedback to N3, to partners such as NBI, and to platforms.

3. Water savings (Green /Blue SEI)

6. RECOMMENDATION DOMAINS

A recommendation is information that farmers can use to improve the productivity of their resources (CIMMYT, 1988). Because it is impossible to make a separate recommendation for each farmer practical compromises have to be made. This is typically done by stratifying the farmers into groups as homogeneous as possible.

We’re implementing this concept on landscapes instead of on farmers, though with an understanding that the anthropomorphic landscape is built by the farmers and land users through their decisions and activities that drive change.

Recommendation domains are spatially defined areas characterized by similar

* Constraints and priorities
* Potentials

3.1 Constraints and priorities

Example constraints: availability of water, access to water, water productivity, resource degradation, soil erosion, slope, soil fertility, climate variability, climate change, limited market access, in-efficient institutions/institutional arrangements, un-suitable policies, sectoral institutions, lack of public investment, lack of technical skills and knowledge, lack of modern inputs, lack of suitable soil and crop management

Different priorities possible, e.g.: poverty reduction, food security, increased productivity, sustainable production, …

Defining/analyzing constraints and priorities ~ GOALS ~ RMS definition (see above)

3.2 Potential

The potential is defined by suitability and impact

* Step 1: suitability maps for each practice (only current or also future?)
* Step 2: clusters of targeted best-bet interventions / strategies (matched to priorities and constraints from above? Strategies coming from N2?)

🡪 identify landscapes within the basin where certain strategies might work

* this feeds into the development of scenario’s
* Step 3: impact assessment (is there also cost/benefit analysis?)

7. PROJECT INTERDEPENDENCIES

Project dependencies are something like:

N2 Landscape RMStrategies are basis for N3 and N4 for mapping and, through scenarios, for N4 impact assessment

N4 will provide feedback on the production and hydrological aspects of the suitability of the targeted areas based on model outcomes; this would influence ‘mapped suitability’ by N3

N2 landscape impacts on WP livelihoods and environment used to ‘ground truth’ validate or somehow confirm or make more accurate N3 and N4 mapping and impact assessment (this must be post field work, so not before 3 and 4 develop methods/models…)

N3 can confirm/demonstrate what is represented by N2 study sites in overall basin context applicability/out-scaling potential of N2 RMS and interventions

Scenarios used by any (N2, N3, N4, N5) are consistent with others at least in a way that is easily communicated